REMARKS

In the August 18, 2009 Office Action[1], the Examiner rejected claim 13 under 35 U.S.C. § 103(a) as being unpatentable over the Abstract of Japanese Patent Application Publication no. 2000-208830 to Tanaka et al. ("*Tanaka*") in view of U.S. Patent No. 4,599,632 to Bethea et al. ("*Bethea*")[2], and rejected claims 14-18 under 35 U.S.C. § 103(a) as being unpatentable in view of *Tanaka*, *Bethea,* and U.S. Patent no. 5,037,769 to Inada ("*Inada*").

Applicants have now amended the specification to correct minor typographical errors and claims 13-18. Exemplary support for the amended features can be found in paragraphs [0068], [0069], and [0091] of the originally filed specification. For example, the claimed "n-type doped compound semiconductor layer" corresponds to at least the sixth compound semiconductor layer disclosed in paragraph [0068] of the originally filed specification; the claimed "semiconductor light absorption layer" corresponds to at least the seventh compound semiconductor layer disclosed in paragraph [0069] of the originally filed specification; the claimed "p-type doped compound semiconductor layer" corresponds to at least the eighth compound semiconductor layer disclosed in paragraph [0068] of the originally filed specification; and the claimed "semiconductor contact layer" corresponds to at least the ninth compound semiconductor layer disclosed in paragraph [0091] of the originally filed specification.

Claims 1-28 are now pending, and claims 1-12 and 19-28 have been withdrawn.

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[1] The Office Action may contain statements reflecting characterizations of the related art and the claims. Regardless of whether any such statements is identified herein, Applicants decline to automatically subscribe to any statement of characterization in the Office Action.

[2] On page 2 of the Office Action, the Examiner allegedly rejects claims 13-18 under 35 U.S.C. 103(a) in view of *Tanaka* and *Bethea*, however, in view of the Examiner's rejections on pages 3 and 4 of the Office Action, Applicant assumes that claim 13 is rejected in view of *Tanaka* and *Bethea*, and claims 14-18 have been rejected under 35 U.S.C. 103(a) in view of *Tanaka*, *Bethea*, and *Inada*. Applicant requests clarification if the assumption is incorrect.

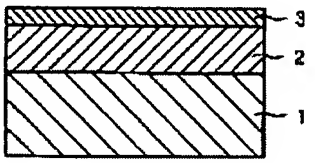
Applicants respectfully traverse the rejection of claim 13 under 35 U.S.C. § 103(a) as being unpatentable in view of *Tanaka* and *Bethea* because a *prima facie* case of obviousness has not been established.

Independent claim 13 recites an infrared sensor including:

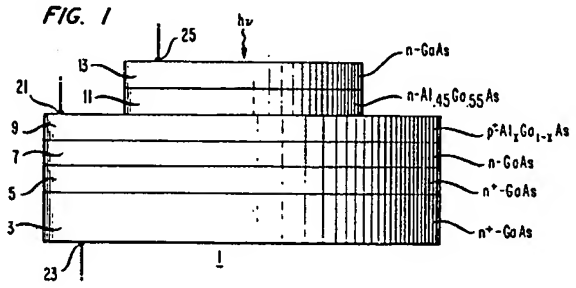
> a substrate . . .
>
> an n-type doped compound semiconductor layer formed on said substrate, said n-type doped compound semiconductor layer composed of an n-type doped material and including indium and antimony;
>
> a compound semiconductor light absorption layer formed on said ~~sixth~~ n-type doped compound semiconductor layer, said compound semiconductor light absorption layer composed of a non-doped or p-type doped material including indium and antimony; and
>
> a p-type doped compound semiconductor layer formed on said compound semiconductor light absorption layer, said p-type doped compound semiconductor layer composed of a material that is p-type doped at a higher carrier density than said compound semiconductor light absorption layer and has a larger band gap than said n-type doped compound semiconductor layer and said compound semiconductor light absorption layer, wherein said p-type doped compound semiconductor layer functions as a barrier layer.

Applicants assert that combinations of *Tanaka* and *Bethea* do not teach, suggest, or render obvious the structure of the infrared sensor including a substrate, an n-type doped compound semiconductor layer formed on the substrate, a compound semiconductor light absorption layer formed on the n-type doped compound semiconductor layer, and a p-type doped compound semiconductor layer formed on the compound semiconductor light absorption layer, "wherein said p-type doped compound semiconductor layer functions as **a barrier layer**," (emphasis added) as recited in claim 13.

Tanka discloses a multilayer thin film of compound semiconductor comprising p-doped InSb layer 2 and undoped or n-doped InSb layer 3 on a GaAs substrate. (Abstract). This structure is shown in the figure copied below.



Bethea discloses a structure comprising a substrate 3, buffer layer 5, a semiconductor layer 7, a semiconductor layer 9, a semiconductor layer 11 with a band gap larger than semiconductor layers 7 and 9, and a contact layer 13. (*Bethea*, col. 2, line 58 to col. 3, line 47). This structure is shown in the figure copied below.



Neither the compound semiconductor multilayer thin film of *Tanaka* nor the photodetector of *Bethea* discloses or suggests the claimed structure recited in claim 13. For example, claim 13 recites "a p-type doped compound semiconductor layer , . . . wherein said p-type doped compound semiconductor layer functions as a barrier layer." The claimed "p-type doped compound semiconductor layer is formed on said compound semiconductor light absorption layer," is "p-type doped at a higher carrier density than said compound semiconductor light absorption layer," has a higher carrier density than the "compound semiconductor light absorption layer," and "has a larger band gap" than the n-type doped compound semiconductor layer and the compound semiconductor

light absorption layer. As is explained with reference to Figure 11 of the specification, the p-type doped compound semiconductor layer functions as a barrier layer against electron diffusion to p-layer side (direction designated as "B" in Figure 11). By acting as a barrier layer, the p-type doped compound semiconductor layer reduces diffusion or leak current from the compound semiconductor light absorption layer to the p-type doped compound semiconductor layer. *See* specification, paragraph [0070].

In contrast, *Tanaka* only discloses three layers including the substrate such that a p-type layer 2 is formed on substrate 1 and an n-type or undoped layer 3 is formed on p-type layer 2. The arrangement of layers in *Tanaka* is not the same as the claimed arrangement of compound semiconductor layers because a p-type layer is formed on substrate 13 in *Tanaka*.

Semiconductor layer 11 of *Bethea* is of the same conduction type as semiconductor layer 7 and functions as an emitter layer when operating as a photo-transistor. (*Bethea*, col. 4, line 59 to col. 5, lines 6). Thus, semiconductor layer 11 of *Bethea* cannot constitute "a p-type doped compound semiconductor layer , . . . wherein said p-type doped compound semiconductor layer functions **as a barrier layer**," (emphasis added) as recited in claim 13.

Moreover, the claimed p-type doped compound semiconductor layer does not interfere with the flow of holes generated by infrared light incidence and the p-type doped compound semiconductor layer increases the photo current to be extracted by facilitating the flow of electrons generated by infrared light incidence in photo current direction (direction designated as "A" in Figure 11). Thus, by using the p-type doped

compound semiconductor layer, the external quantum efficiency of the infrared sensor is improved and the sensitivity of the element can be increased.

Even if *Tanaka* and *Bethea* are considered in combination, such a combination does not teach, suggest, or render obvious the features of claim 13. On page 3 of the Office Action the Examiner acknowledges the differences between *Tanaka* and *Bethea* and states that "Tanaka as modified by Bethea does not specifically disclose a sixth, seventh, or eighth compound semiconductor layer."[3] Instead, the Examiner alleges that "[i]t would have been obvious to modify the invention to include multiple layers for purpose of carrier mobility and optimum performance, since it has been held that mere duplication of the essential working parts of a device only involved routine skill in the art (St. Regis Paper Co. v. Bemis Co., 193 USPQ 8)." Office Action, page 3. This, however, is not correct.

In *St. Regis Paper Co.*, the court held that the plaintiff was not entitled to a patent to a particular bag ("Lokey bag") because the "method of strengthening a certain type of bag" by "putting one bag inside of another" is obvious (*See St. Regis Paper Co. v. Bemis Co.*, 549 F.2d 833, 839). The court further stated that the plaintiff would have been entitled to a patent if "the fusion of the old elements . . created a synergistic combination." *Id.*, p. 838. Claim 13 differs from the Lokey bag. That is, the stacking of a plurality of compound semiconductor layers recited in claim 13 substantially differs from the principle of strengthening a certain bag by putting one bag inside of another. In *St. Regis Paper*, each layer of the multi-layered bag was identical to the other layers. In contrast, the claimed n-type doped, light absorption layer, and p-type doped

[3] As amended, claim 13 recites n-type doped, light absorption, and n-type doped compound semiconductor layers instead of sixth, seventh, and eighth compound semiconductor layers.

compound semiconductor layers are not identical to each other at least because "the p-type doped compound layer functions as a barrier layer," as recited in claim 13. At the very least, claim 13 does not recite "duplicating" of compound semiconductor layers to merely strengthen an infrared sensor, because the p-type doped compound semiconductor layer is not a mere duplication of the essential working parts such as the n-type doped and light absorption semiconductor layers.

Moreover, duplicating semiconductor layers of *Tanaka* or *Bethea* would still not teach or suggest the structure of the claimed infrared sensor, because none of the references disclose or suggest a layer corresponding to the claimed p-type doped compound semiconductor layer.

Any duplicating of the layers of *Tanaka* or *Bethea* to constitute the claimed features of claim 13 would require the use of impermissible hindsight. This, however, is not proper because a conclusion of obviousness cannot be based on what the Examiner gleans from the Applicants' specification or claims. *Orthopedic Equip. Corp. v. Unites States*, 702 F.2d 1005, 1012 (Fed. Cir. 1983). Thus, it would not have been obvious to modify *Tanaka* and *Bethea* to provide all of the features of claim 13.

Accordingly, *Tanaka* and *Bethea* do not teach, suggest or render obvious the features of claim 13. Therefore, a *prima facie* case of obviousness cannot be established. Accordingly, claim 13 is allowable over *Tanaka* and *Bethea*.

Applicants respectfully traverse the rejection of claims 14-18 under 35 U.S.C. § 103(a) as being unpatentable in view of *Tanaka*, *Bethea*, and *Inada* because a *prima facie* case of obviousness has not been established.

Claims 14-18 depend from claim 13 and thus requires all elements of claim 13. As discussed above, *Tanaka* and *Bethea* do not teach or suggest the structure of the infrared sensor. *Inada* also does not teach or suggest these claim elements, which are missing from *Tanaka* and *Bethea*.

Therefore, a *prima facie* case of obviousness has not been established and claims 14-18 are allowable over *Tanaka*, *Bethea*, and *Inada* at least due to their dependence from claim 13, and further due to the features recited therein.

For example, claim 16 recites "a **compound semiconductor contact layer** formed on said p-type doped compound semiconductor layer, said compound semiconductor contact layer **composed of a material including indium and antimony and p-type doped** at a carrier concentration equal to or greater than the carrier concentration of said p-type doped compound semiconductor layer," (emphasis added) as recited in claim 16.

As noted above, *Tanaka* discloses a compound semiconductor multilayer thin film including three layers: a substrate 1, a buffer layer 2, and an active layer 3. Thus, *Tanaka* cannot teach or suggest an additional layer that is "a compound semiconductor contact layer formed on said p-type doped compound semiconductor layer," as recited in claim 16.

Further, *Bethea* discloses a photodetector including at least a substrate 3, a buffer layer 5 formed on substrate 3, a first semiconductor region 7 formed on buffer layer 5, a p-type second semiconductor region 9 formed on the first semiconductor region 7, and an n-type third semiconductor region 11 formed on the second semiconductor region. The fourth layer in *Bethea* is an n-type third semiconductor

region 11. Thus, *Bethea* cannot teach or suggest "a compound semiconductor contact layer . . . , composed of a material including indium and antimony and **p-type doped**," (emphasis added) as recited in claim 16.

Moreover, *Inada* also does not teach or suggest these claim elements, which are missing from *Tanaka* and *Bethea*.

Accordingly, claim 16 is also allowable over *Tanaka*, *Bethea*, and *Inada* for this additional reason.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully request reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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